

Listing of Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1-33.(canceled)

34. (currently amended) A semiconductor wafer processing system having a vacuum environment therein and comprising:

 a semiconductor wafer processing module that includes vacuum chamber having a wafer holder therein configured to hold a semiconductor wafer for processing in the vacuum environment;

 at least one maintenance item in the processing module in the vacuum environment, the at least one maintenance item including a ring, a shield, an insulator, an adapter, a baffle, a plate or another internal chamber component of a type that may be removed for cleaning or maintenance, or to be replaced;

 the processing module also having mounting structure therein configured to removably mount a maintenance item in the vacuum environment in the chamber of the processing module;

 the maintenance item being removably mounted on the mounting structure;

 a transfer system having a wafer transfer mechanism operable to transfer a semiconductor wafer within the vacuum environment between the transfer system and the processing module;

 a controller coupled to the processing module and the transfer system and programmed to control the wafer transfer mechanism to transfer a semiconductor wafer[[s]] to and from the wafer holder in the vacuum chamber of the processing module and through the transfer system;

 the controller also being programmed to control the wafer transfer mechanism to transfer the maintenance item to and from the mounting structure in the vacuum chamber of the processing module and to and from the transfer system without exposing the processing module to an outside environment.

35.(new) The processing system as claimed in claim **34**, further comprising:
a maintenance system comprising a storage assembly configured to store at least one maintenance item therein and an exchange system operable to transfer a maintenance item between the transfer system and the maintenance system without exposing the vacuum environment to an outside environment.

36.(new) The processing system as claimed in claim **35**, further comprising:
an isolation assembly that includes a gate valve assembly and is coupled between the maintenance system and the transfer system.

37.(new) The processing system as claimed in claim **35**, wherein the exchange system comprises:

a drive system, at least one transfer arm coupled to the drive system having an end effector thereon; and

the controller being programmed to control the drive system to move the at least one transfer arm and end effector to transfer the maintenance item between the maintenance system and the processing module and to transfer the wafer between the transfer system and the wafer holder in the vacuum chamber of the processing module.

38.(new) The processing system as claimed in claim **35**, wherein:
the maintenance system includes a storage assembly;
the exchange system includes a drive system, at least one transfer arm coupled having an end effector thereon and coupled to the drive system; and
the controller is programmed to control the drive system to move the at least one transfer arm and end effector to transfer the maintenance item between the transfer system and the storage assembly in the maintenance system.

39.(new) The processing system of claim **34** wherein the processing module is an etching module and the wafer holder is upwardly facing in the vacuum chamber thereof, and wherein:

the maintenance item is an annular member in a mounting position in the etching module surrounding a wafer support area of the wafer holder where the maintenance item is prone to being etched by an etching process performed on a wafer on the wafer holder; and

the maintenance item is removable from the processing module in part by a lifting of the maintenance item from the mounting position.

40.(new) The processing system of claim **34** wherein the processing module is a deposition module and the wafer holder is upwardly facing in the vacuum chamber thereof, and wherein:

the maintenance item is an annular member in a mounting position in the etching module surrounding a wafer support area of the wafer holder where the maintenance item is prone to collecting deposits of material thereon when a deposition process is performed on a wafer on the wafer holder; and

the maintenance item is mounted in its mounting position in the deposition module so as to be removable from the processing module in part by a lifting of the maintenance item from the mounting position.

41.(new) The processing system of claim **34** wherein:

the mounting structure includes a lifting mechanism configured to move the maintenance item from a mounting position in which it is used during processing to a position for pick up by the transfer mechanism.

42.(new) The processing system of claim **41** wherein:

the maintenance item is an annular ring configured to surround a wafer on a wafer support;

the mounting structure includes a set of lift pins operable to lift the ring into position for pick up by a wafer transfer arm.

43.(new) The processing system of claim **41** wherein:

the maintenance item is supported within the processing module from the top of the processing module;

the mounting structure includes a set of elements operable to releaseably hold the maintenance item and to lower the maintenance item into a position for pick up by a wafer transfer arm.

44.(new) The processing system of claim **41** wherein:

the transfer mechanism includes a wafer transfer arm more particularly configured to pick up a wafer and a separate transfer arm more particularly configured to pick up a maintenance item.

45.(new) The processing system as claimed in claim **34**, wherein the processing module is at least one of an ALD module, a deposition module, a coating module, a patterning module, a developing module, a metrology module, a thermal processing module, and a cleaning module.

46.(new) A method of operating a semiconductor wafer vacuum processing system that includes a wafer processing module that is coupled to a transfer system having an interior with a vacuum environment therein, to replace expendable or serviceable components from within a processing module of the system, the method comprising:

performing a vacuum process on a wafer supported in a vacuum environment in a vacuum chamber of the processing module;

operating the transfer system by moving a wafer transfer arm thereof into or from the processing module to move a semiconductor wafer to or from the processing module;

presenting a maintenance item that is an internal component of the processing module in a position for pick up by a transfer arm of the transfer system;

further operating the transfer system by moving a wafer transfer arm thereof into the processing module and picking up the maintenance item from the position for pick up therewith and removing the picked up maintenance item from the processing module without exposing the interior of the processing module to an outside environment.

47.(new) The method of claim 46 wherein:

the performing of the vacuum process on the wafer includes etching the wafer in the vacuum environment in the vacuum chamber while exposing the maintenance item to an etching process when it is in a mounting position in the vacuum chamber.

48.(new) The method of claim 46 wherein:

the performing of the vacuum process on the wafer includes depositing material on the wafer in the vacuum environment in the vacuum chamber while exposing the maintenance item to depositing material when it is in a mounting position in the vacuum chamber.

49.(new) The method of claim 46 wherein:

the presenting of the maintenance item includes lifting the maintenance item from a mounting position in the vacuum chamber.

50.(new) The method of operating a processing system as claimed in claim 46, the method further comprising:

operating the transfer system by moving a wafer transfer arm thereof to transfer a second maintenance item from a maintenance system that is coupled to the transfer system without exposing the interior of the processing module to an outside environment; and

removably mounting the transferred second maintenance item inside of the processing module.

51.(new) The method of operating a processing system as claimed in claim 46 further comprising:

with the controller, monitoring a processing recipe for the processing module; and

determining with the controller when to exchange the first maintenance item with a second maintenance item;

the presenting of the maintenance item and the further operating of the transfer system being performed in response to the determination.